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Mulquin, Marie-Eve; SENGGER, Katja

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Interregional transfers and economic convergence of regions

Marie-Eve Mulquin et katja Senger

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Contact : cerpe@fundp.ac.be

Abstract

Large disparities exist among European regions. Not only do they exist across national borders, but also within many states. Countries redistribute a substantial amount of wealth through taxation and social security systems in order to promote equity among individuals. Such inter-personal redistribution has an impact at regional level, even in the absence of explicit regional policy at national level.

Economic theory can help explain different levels of economic development as well as convergence and divergence dynamics among economies. Economic theory also suggests that taxes and redistribution of income are generally distorting economic activity.

This paper empirically investigates convergence among European regions and the impact of inter-personal transfers on regional growth. Standard beta-convergence regressions are done in a cross section as well as in a panel data setting. Results suggest that convergence is taking place among the 229 European regions in the dataset, since a negative relationship between the initial level of income and the subsequent growth rates exist. Convergence within countries happens much slower, which indicates that the observed convergence is due to a convergence across countries. In order to estimate the impact of transfers, a transfer index allowing for a separate analysis of contributing and receiving regions is computed. Once controlling for regional fixed heterogeneity, no significant effect of transfers on income growth is found, neither on the contributing nor on the benefiting regions.

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1. Introduction

The aim of the present paper is to analyse the impact of interpersonal transfers on regional growth in the European regions. While a lot of research has been done on convergence among European regions in general and on the effectiveness of the EU structural funds in particular, relatively few studies have analysed the impact of interpersonal transfers through taxation and social security systems on growth rates at a regional level.

The economic gap between member states of the European Union has been decreasing over the last decades. The same is, however, not observable at regional level. While this seems rather contradictory, there is an explanation for this development. The most important reason is that disparities are increasing *within* many of the member states. This is mostly due to a spatial concentration of economic activities, meaning that there are high growth rates in urban centres, typically the capital region, while peripheral rural areas grow slower or experience structural problems.

In the light of economic geography, agglomeration of economic activities is the natural outcome of market forces, as firms benefit in terms of efficiency from economies of scale and higher demand in more densely populated areas. A country trying to foster growth might rather promote economic efficiency by supporting highly developed urban areas. While this is likely to increase the growth rate at country level, it might leave behind lagging regions and the disparities between urban centres and rural areas will widen.

The lack of within-country convergence is sometimes brought in relation with distorting redistributive measures at national level through central governments that might prevent structural adjustments and convergence. While the effect of fiscal policy measures, most notably taxation and expenditure policies on economic growth have been intensively studied, the impact of interpersonal transfers has received relatively little attention so far in the convergence literature.

The paper comprises a theoretical and an empirical part. Section two and three will analyse the relationship between redistribution, growth and convergence on the basis of economic theory. Section two will summarize the most important growth theories and dynamics that might explain unequal economic performance across regions and a possible convergence or persistence in regional disparities. Section three discusses the motivation for income redistribution and some theoretical aspects of the relationship between fiscal policy and economic growth. It also highlights the trade-off between equity among individuals and regions on the one hand and efficiency considerations on the other hand. Section four summarizes the most important empirical contributions to the convergence literature. Special attention is given to studies focusing on convergence among European regions and on the effect of transfers and other redistributive measures on growth and convergence¹. Section five presents the empirical analysis, which first looks at convergence across 229 European regions from 16 countries

¹ Sections 2 to 4 are mainly based on the Katja Senger's Master thesis (2011).

between 1995 and 2008 in terms of primary income. The impact of net government transfers on regional growth rates will be analysed in the framework of a β -convergence model. Similar studies, even though few exist, have found controversial results of redistributive measures on growth and convergence such that there is no clear indication of what should be expected from the empirical analysis. The section will close with a detailed analysis of the results. Section 6 concludes.

2. Growth and convergence

2.1. Introduction

The aim of this section is to present theories that allow for an explanation of disparities among European regions. In particular growth theories and the theory of economic geography will be reviewed in order to see how these theories explain regional inequalities and what they predict for economic convergence of regions.

2.2. Growth models and convergence

2.2.1. Growth models: Neoclassical versus endogenous growth theory

The *neoclassical model* is based on the idea that an economy grows by saving and investing in its capital stock and that once a certain level of capital per person is reached – the steady state – the per capita growth rate will be zero (Acemoglu, 2009), (Barro & Sala-i-Martin, 2004).

The main equation describing the capital accumulation process in this model is the following:

$$\dot{k} = s \times f(k) - (n + \delta) \times k$$

where k is the capital stock per person, \dot{k} is the net increase in the capital stock per person, $f(k)$ is the production function with decreasing marginal returns to capital and labour, s is the savings rate, n is the population growth rate and δ is the depreciation rate of capital.

As the economies' capital stock per capita is increasing, returns to capital are diminishing and tend towards zero at the steady state where savings (and thus investments) do exactly offset the diminution of the capital stock due to depreciation and population growth.

Factors that determine growth and steady state in the neoclassical model are all exogenous. Changes in the savings rate, the population growth rate or the depreciation rate can raise the level of the steady state but, due to the diminishing returns to capital, any economy will sooner or later converge to its own steady state. The further away an economy is from its steady state, the higher its growth rates per capita will be.

Does it mean that economies will converge?

Yes, if they have the same steady state. Under the assumption that the economies only differ in terms of their initial capital stock, but have the same savings rate, the same population growth rate and the same

rate of capital depreciation, the neo-classical growth theory predicts convergence among economies. We speak in this case of *absolute β -convergence*².

If economies do not have the same savings rate, the same population growth rate and the same rate of capital depreciation, convergence to their own steady state do not lead to inter-economies convergence. However if, controlling for special characteristics of the economies in the sample, there is a negative correlation between the initial level of income and the subsequent growth rate, we will say that *conditional β -convergence* holds³.

Endogenous growth theory does not predict convergence. Contrary to the neo-classical growth theory, it does not assume diminishing returns to capital and there is no convergence towards a steady state. The simplest of such models is the *AK model*. (Acemoglu, 2009) (Sala-i-Martin, 1996) In this model, the production function does not have the same properties as in the neoclassical models with diminishing marginal returns to factor inputs. Rather, the production function takes the linear form of $Y = AK$. Capital being the only input factor here refers to a wider concept, including physical as well as human capital. Marginal returns to capital are constant given the production function and as a result, capital accumulation is sufficient to ensure growth.

The growth rate of the capital stock per capita using this production function becomes:

$$(\dot{k}/k) = (s \times A) - (n + \delta)$$

As long as $(s \times A) > (n + \delta)$, the economy experiences a positive and constant per capita growth rate. Considering two countries, one poor economy with a low capital stock and one rich economy with a high capital stock, the AK-model predicts a constant growth rate for both economies. Under the assumption that both countries have the same characteristics, meaning the same savings rate, same technology, same population growth rate and same depreciation rate, both countries will have the same growth rate. If they differ in these parameters, they might have different growth rates. But there is no indication of convergence in the sense of the neoclassical model, as there is no systematic relation between the initial level of capital stock and the growth rate of a country. Catching up can occur or not.

2.2.2.Considerations for convergence

Theories on endogenous growth have been used as an explanation why convergence among countries in a worldwide setting is not empirically verified and in a sense rejected the predictions of the neoclassical growth models. The first and still most important contributions to the endogenous growth theories come from Lucas (1988), Romer (1986) and Rebelo (1991), who acknowledge the fact that technology is not exogenous but rather the result of a rational economic activity, such as research and learning-by-doing.

² The term of *β -convergence* was first introduced by Sala-i-Martin (1990)

³ The concept of *conditional β -convergence* was introduced by Barro and Sala-i-Martin (1991) and also studied empirically by Mankiw et al. (1992).

Another explanation for the absence of convergence is that what we verify in the world is not the phenomenon of absolute convergence but rather conditional convergence. The absence of convergence among countries worldwide might thus not be a reason to reject the neoclassical growth theory, but rather to re-examine it in more detail. Precisely, the prediction of the neoclassical model is that the growth rate of an economy is negatively related to the distance that separates it from its steady state. It follows that poor countries grow faster than rich ones if all countries converge towards the same steady state. In this case it holds true that poor countries are further away from their steady state because they have a lower level of capital per person than rich countries and will thus catch up. Hence, the neoclassical model does not predict absolute convergence among all countries, it rather predicts that countries with the same parameters converge, which is equivalent to the concept of conditional β -convergence.

Sala-i-Martin (1996) attempts to amend the endogenous growth model so that it predicts convergence as the neoclassical model does by endogeneizing the savings rate or the population growth rate. He then concludes that the model either still does not predict convergence or only does so if assumptions are taken that are generally seen as implausible. Hence, he concludes that among the two groups of growth theories the neoclassical model is the one that best predicts what is empirically verified.

A rather new field of studies which might add to explaining the differences in income and GDP between spatial units and the possible lack of convergence in particular among regions is that of economic geography which will be presented in the following section.

2.2.3. Convergence and the new economic geography

The aim of economic geography is to explain why certain economic activities localize in certain geographical zones. The main forces driving the new economic geography are increasing returns to scale and the existence of transport costs. For the analysis of regional disparities the two opposite forces of *agglomeration* and *dispersion* are particularly interesting. Depending on which of the two is stronger, models of economic geography could explain regional divergence (if agglomeration forces dominate) or convergence (if dispersion forces dominate). Agglomeration forces are due to the fact that a firm producing under increasing returns to scale profits from centralizing its production activities in one region and serving the market in other regions from there. Dispersion forces mainly come from the existence of transport costs but also from congestion effects. A company with one central location faces transport costs when serving other markets than the home market. These costs work as a dispersion force which might make firms locate their activities in different regions in order to be closer to its customers and avoid transport costs.⁴

The most important work in this field of study is the Krugman *core-periphery model* (Krugman, 1991) which explains exactly these dynamics. The main setup is that there are two regions, one big “core”

⁴ For an overview of recent location theories in the framework of the new economic geography see Puga (2001)

region with a higher population share and one small “peripheral” region. There is one production sector that is perfectly competitive and produces agricultural products under constant returns to scale. The other sector is imperfectly competitive and firms produce manufactured goods under increasing returns to scale. Workers are immobile across regions. Firms will locate in the region that has the higher demand, thus the bigger region. It is clear that the big region will attract a bigger share of industrial production.

With regards to explaining regional inequalities in Europe, transport cost should receive special attention. The Krugman model predicts that the lower the transport cost, the stronger agglomeration forces will be. This makes sense, as the firm loses relatively less in demand when serving other regions from one centralized location if transport costs are low, while still profiting from increasing returns to scale due to centralized production. In practise, economic integration like in the European Union decreases transport costs and consequently increases the share of sales each firm located in the core region can make in the peripheral regions. Hence, according to this model, economic integration favours agglomeration in general. However, as the size of industry in the core region increases further, so do factor prices because labour is assumed to be immobile across regions. This tends to drive some firms out of the core region. Further integration with low transport costs can thus also lead to more dispersion. This highlights very well the two different forces at play and the fundamental ambiguity of the effects of economic integration on the localization decision of firms.

Krugman (1991) further elaborates this model, taking into account the mobility of workers. If workers are totally mobile, they tend to cluster together with firms since wages are higher due to increased labour demand in the core region. More workers with higher income will in turn attract more firms and this leads to an endogenous mechanism which results in total agglomeration in one region. This is sometimes called the “*snowball-effect*” and describes the fact that two regions that are initially similar, might diverge substantially, if one of the two regions is able to attract only slightly more companies, which triggers the above described dynamics. Agglomeration, in this model, is then even stronger if workers are mobile. On the other hand, if workers are immobile as in Krugman & Venables (1995), the increased labour demand in one region will be reflected in higher wages, since workers do not migrate. These higher factor prices might work as dispersion forces, as some firms might locate in the region with lower wages. This congestion effect works against extreme outcomes such as full agglomeration of activities in one region. Especially if transport costs are low, a firm finds no reason for locating its production in the bigger market where factor prices are high and rather chooses the region with the lowest wages.

Also Puga (1999) elaborates on this “bell-shaped” curve between economic integration and spatial concentration and summarizes the dynamics as follows: If trade costs are high, firms will split between regions to meet local demand. If trade costs are intermediate, regional disparities might occur if some regions are able to attract slightly more companies than others, but not necessary lead to full

agglomeration. If trade costs are very low, firms will locate in regions with lowest wages and agglomeration unravels.

Another important aspect is the existence of externalities that encourages firms to choose a location that is close to other firms and thus leads to the emergence of clusters. Generally speaking, firms profit from the presence of other firms close by. In this context, Fujita, Krugman & Venables (1999) show that the levels of welfare might diverge among regions. It is often distinguished between localization (intra-industrial) and urbanization (inter-industrial) economics. The first category can be attributed to Marshall (1920), who emphasizes increased productivity within an industry due to specialization, technological and intellectual spill-overs and pooled markets. The second one goes back to Jacobs (1969), suggesting that diversity in big cities leads to higher productivity also across industries. Similar to that, Duranton & Puga (2004) suggest agglomeration externalities in learning, sharing and matching. Independent of where these externalities have their sources, productivity should be higher in areas with a high level of economic activity. This effect should therefore further encourage agglomeration and adds to understanding regional disparities in terms of production and income.

3. Regional disparities and redistribution

3.1. Regional policy rationale

The main motivation for any inter-regional redistribution policy is that the distribution of economic activities generated by market forces yield outcomes that are considered “unfair” or socially not desirable. A country or a society or even the European Union as a supra-national body is obliged to show spatial solidarity and promote equity among regions and people residing in these regions. (Puga, 2002)

Insights from economic theories are an important fundament behind any redistribution effort, as they can help to predict what the outcome without any intervention might be and to decide in which direction policies should go in order to reach certain objectives.

An important issue in this context is the trade-off between equity and efficiency. It is intuitive that regional policy should focus on poor regions, but it is possible that by doing so, resources are allocated to places where they are less productive and it is questionable if this is desirable. Market forces normally lead to agglomeration of economic activities through economies of scale and spatial concentration can be an important source of efficiency gains, while the spatial redistribution of economic activities, while more equal, might entail efficiency losses. (Gérard-Varet & Mougeot, 2001)

3.2. Redistributive policies versus vertical transfers

Redistributive policies affecting the disposable income of households redistribute income between individuals rather than between regions. They nevertheless have an indirect effect at spatial level. This is quite forward since less prosperous regions are normally characterized by lower per capita GDP and income and will have a bigger share of unemployed. As individuals residing in these regions will pay

relatively less income tax and might in addition benefit from social transfer payments or other benefits, interpersonal transfers are indirectly redistribution of income from relatively rich to relatively poor regions. These interpersonal transfers together with intergovernmental vertical transfers are the two main means of redistributing income by central governments.

One important difference between explicit regional policy and income redistribution is that explicit regional policies are spatially targeted territorial policies aiming at improving the competitiveness of lagging regions and addressing structural problems in a sustainable way. Redistributive measures carried out by the federal government almost entirely impact consumption by increasing disposable income in poorer regions. They do, however, not address structural problems or other challenges to the productive potential of lagging regions.

The focus in the next sections will lay on interpersonal transfers, hence the redistribution of income by central governments through income taxation and social security systems.

3.3. Principles of income redistribution

3.3.1. Primary and disposable income

In the context of interpersonal redistribution, two concepts of income should be mentioned, that will be used throughout the remainder of this paper. Primary income refers to original income an individual earns before paying any taxes or receiving any benefits through the fiscal system. Disposable income is the final income one has after deduction of taxes and attribution of any kind of benefits by the government. Hence, the difference of the two can be considered as an indicator of the amount of interpersonal income redistribution.

3.3.2. Equity and redistribution

The main motivation for redistributing income among individuals is that it is commonly assumed that market forces lead to outcomes that leave some better off and others worse off and that a society should aim at promoting an equal well-being for all its citizens. This is also referred to as equity and involves the concept of solidarity among the individuals of a society. Moreover, it is assumed that more equity is better for a society as a whole and that some externalities exist from equity. Rich people tend to be happier when others around them are well-off too. (Tesch, 2008)

One normally distinguishes between end-result equity and process equity. (Tesch, 2008) In defining the goals of a redistributive policy the difference between the two concepts can be important. *Process equity* aims at giving each individual the same initial chance to do whatever he or she is able and willing to do. Process equity also assumes that as long as the initial conditions are fair, any final outcome is also fair because everybody had the same chance. *End-result equity*, on the other hand, assumes that market forces produce large disparities in income and wealth among people and divides a society in two, some are better off while others are worse off. At some point, it is likely that the society will want to reduce

the disparities. Redistributive measures typically pursue the goal of end-result equity and the aim is to implement the fairest system possible to tax the rich and transfer to the poor.

Under end-result equity, defining what is presumed as “unequal distribution” of income is one question, another one is the amount of redistribution once a society has decided to redistribute. The question of distributive justice is a difficult one to answer, because it has to take into account the losses faced by those who pay through taxation and the gains made by those who receive transfers. From welfare theory it follows that social welfare can be increased by transferring income from relatively rich towards relatively poor individuals, because the increase in social welfare from giving the poor person an additional unit of income exceeds the loss incurred to social welfare from taking a unit of income away from a rich person. It is also intuitive and broadly accepted that an additional Euro is likely to be worth more to a poor person than it would be to a rich person. (Tesch, 2008) This intuitive idea is also called the *ability-to-pay principle*, referring to the fact that a transfer system should equalize everyone's sacrifice.

Another concept justifying the redistribution of wealth from richer to poorer individuals is the *benefits-received principle*. (Tesch, 2008) The main idea is that some individuals might benefit more from the provision of public goods than others. It tries to relate the amount of taxes paid to the amount of public goods one would receive in return. The idea is to ask whether high income individuals demand a bigger share of public services than low income individuals and if this demand is sufficiently higher to justify redistribution. There is evidence that some public services are allocated proportionally to income. For example, it is observed in many countries that children from low-income families either do not go to university or go to inferior universities than children from high-income families. In this case, if both, low-income and high-income families paid the same amount of taxes, high-income families would benefit relatively more from the public provision of education. The application of a transfer scheme including progressive income taxation and attribution of benefits and social transfers is then a means of compensating low income individuals for the extra demand for public goods exhibited by high income individuals. (Lambert, 2001)

3.3.3. The equity-efficiency trade-off

Having explored the idea of equity as a justification for redistribution of income we now address possible distortions and negative growth effects caused by taxation and redistribution. It would be the best solution in terms of equity to redistribute until everybody has the same level of income. It is clear that this is not feasible. Any incentive to work would be immediately abolished. Transferring normally involves an efficiency cost that has to be compared to the gains arising from a more equal distribution of income.

Taxes and redistribution in general are said to be distorting, since they induce an efficiency loss in the exchange mechanism in the marketplace, because agents do not face the same prices anymore. (Tesch,

2008). The problem can easily be illustrated when thinking about wages. Wages that are relevant for workers are wages after taxes, hence the wage that is ultimately available for consumption. From a firms perspective however, wages before income tax and social security is applied is of interest, since this is the cost the firm actually faces and hiring decisions are based on this entire wage. Hence, in terms of labour, firms and worker face different prices and the income tax is said to be distorting.

In general, economic theory predicts a negative relationship between the level of taxes and economic growth. The explanation is that taxes reduce the incentive to invest in the taxable activity. Income taxes typically reduce the incentive to work and discourage effort. (Poulson & Kaplan, 2008) Barro (1990) and Barro and Sala-i-Martin (1992) analysed the effect of tax policy and government expenditure in various models of endogenous growth. They consider the growth effects of distortionary and non-distortionary taxes as well as the expenditure side, namely whether government expenditure is productive or unproductive. They show that the growth rate is decreasing in the rate of distortionary taxes and increasing in government productive expenditure, while it is unaffected by non-distortionary taxes.

In the framework of this paper, the expenditure side of the budget is not considered. Gemmell and Kneller (2002) classify among the distortionary taxes income and profit taxes, social security taxes and payroll and manpower taxes. The redistribution of income is to a very big extent done through income taxation and social security taxes. The theory thus predicts a negative impact of taxes and redistribution on growth.

4. Empirical evidence on convergence and fiscal policy

4.1. Introduction

This section will provide a detailed overview of the empirical literature on convergence. It will be split in two parts, the first of which will look at studies on income or GDP convergence. Studies from different countries and regions will be presented to have a broad overview of the empirical literature in the convergence debate. Given the topic of this paper, special attention will be given to studies on convergence in Europe.

The second part will provide a review of studies on the impact of redistribution on economic growth and convergence. Relatively few studies have been conducted till now on the impact of inter-personal transfers on economic convergence of regions in Europe.

4.2. Evidence on convergence

An extensive empirical literature on the process of economic convergence at country or regional level exists. Since an exhaustive overview is not possible, this section will try to summarize some of the most important empirical works, with special attention to what is most relevant in the light of this paper and the empirical analysis that follows. It will highlight the fact that empirical works find convergence as well

as divergence among countries and regions, depending on the dataset, the time period and the methods applied. A big part of this section will focus on empirical evidence from European regions.

Most empirical papers find no proof of absolute β -convergence in worldwide datasets. If we consider the framework of the neoclassical growth theory, this is not too surprising, since it is unlikely that countries in a worldwide dataset have similar characteristics and convergence towards the steady state. Contrary to that, absolute β -convergence is usually found among countries or regions that are similar, such as countries belonging to the European Union. Conditional convergence, hence controlling for country or regional specific characteristics, is sometimes also found in heterogeneous datasets.

Probably, the most important empirical studies go back to Robert Barro and Xavier Sala-i-Martin. In one of their first papers on convergence they analyse the growth and dispersion of income in the United States since 1880. (Barro & Sala-i-Martin, 1991) They find evidence that poor states grow faster than rich states and they conclude that the gap between poor and rich states diminishes at a rate of about 2% per year. Applying the same framework to 73 regions in 7 countries in Western Europe since 1950, they find similar results. The rate of convergence is again about 2% per year and this value is similar for estimates across all regions and estimates within countries.

Sala-i-Martin (1995) tests for absolute and conditional β -convergence on a variety of datasets. He finds no absolute convergence in a worldwide dataset of 110 countries for the period 1960-1990, but he confirms the existence of convergence among OECD countries, across the United States, across Japanese Prefectures and also across European regions. Conditional convergence can even be verified in the worldwide dataset.

Gaulier et al. (1999) use panel data to estimate convergence in a worldwide sample, among OECD countries and among the EU15 countries and finds no convergence in the worldwide dataset, but conditional convergence among OECD countries and absolute convergence among EU countries.

Quah (1995) argues that the consistent findings of a rate of convergence of 2% per year could be misleading and due to a unit root in the times series. He suggests a model that allows for convergence clubs to form endogenously, which results in a polarization of the income distribution across economies and he finds some empirical evidence for this theory. A related study by Bernard & Durlauf (1995) based on time series analysis and cointegration techniques examines convergence of output among 15 OECD countries from 1900 to 1987 and the authors find little evidence for convergence among these economies. Coulombe and Lee (1998) analyse the evolution of regional disparities in per capita income and output in Canada. They analyse β -convergence and divide the study into four sub-periods. Their analysis shows that on average convergence has been taking place across Canadian provinces since 1926, but it is not a smooth process over time. Most of the decline in disparities happened during the period 1950-1977, while during other periods dispersion increased. Similar to Quah, Bernard & Durlauf, they

highlight the possibility of a unit root in the time series that might lead to misleading interpretations concerning convergence.

The evolution of disparities among European regions has been subject to extensive empirical research.

Barro and Sala-i-Martin extended their analysis from 1991 to 90 European regions and longer time periods (Barro & Sala-i-Martin, 1992a). For the period 1950-1990, they find β -convergence across European regions. They further estimate the within country convergence for Germany, United Kingdom, France, Italy and Spain and find estimates between -0.01 (Italy) and -0.03 (UK), results that are very close to what has been found for the US. Fagerberg and Verspagen (1996) test β -convergence among European regions over the period 1950-1990 and find similar estimates as Barro and Sala-i-Martin, however, with some fluctuations when the sample is split into several time periods of 10 years. The convergence process seems to have slowed down during 1980s with respect to the previous years. Convergence rates are lower if within-country convergence is considered. In a more recent study, Arbia and Piras (2005) use panel data to test for convergence among European regions. They first test a cross section model on a sample of 125 regions belonging to 10 European countries during the period 1980-1995 and find β -convergence. When using a panel data estimation and accounting for the spatial dependence among regions, they find again β -convergence among European regions and a convergence rate of 3.6%.

Rather mixed results are found by other authors. Cappelen et al. (2002) analyse 95 European regions from 1980 to 1997 and find that the standard deviation of per capita GDP has declined only very little. When Spain, Portugal and Greece are excluded from the sample, it has even increased. This suggests that the small decline in inequalities is due to a catching up of the Southern European countries during this period, while inequalities within countries persist or even increase. Bouvet (2010) finds that generally inequalities have decreased since 1977, but this decrease is attributed to between-country reduction in inequalities. She studies a sample of 197 NUTS2 regions between 1977 and 2003 and finds substantial fluctuations in inequalities until the beginning of the 1990, with periods of increasing as well as decreasing disparities. Only from 1993 onwards, she finds a continuous decrease in regional inequalities across all regions. Within country inequalities have increased since the mid-1990s, only Southern European countries experienced a sizable reduction in within-country inequalities after their accession to the EU. Boldrin and Canova (2001) find no evidence for convergence among European regions. They estimate different specifications of a β -convergence regression on a dataset of 185 European regions from 1980-1996 and find either positive estimates for β or insignificant estimates, or both. They further report that there is strong evidence of a catching up of poorer regions to the EU-average during the period 1950-1975, but this process largely stopped over the next two decades.

4.3. Convergence and fiscal policy

A vast empirical literature exists on the impact of fiscal policies on economic growth in general and on regional growth and the evolution of regional inequalities in particular. We will in particular focus on the impact of fiscal and redistributive policies.

The framework for analysing the effect of fiscal policy on growth can be extended to investigate regional convergence. If fiscal policies are able to enhance growth in poorer regions relative to the growth rate in richer regions, fiscal policies will ultimately contribute to convergence across regions. Empirical studies highlight different ways in which the role of such policies can be studied. It should be noted that, given the topic of this paper, the focus will lie on policies that redistribute income through taxation and social security systems and will not consider the expenditure side of the government budget.

Concerning the impact of fiscal policies on growth, one important contribution comes from Barro (Barro, 1999), who refers to the well-known argument that transfer payments and the levying of taxes distort economic decisions and the more income is redistributed in an economy, the bigger the distortions are. Investments are reduced and consequently economic growth. He empirically studies a broad panel of countries from 1960 to 1995 and finds that income-equalizing policies are growth enhancing only for poor countries, but lead to a reduction in overall growth rates in rich countries, which face a trade-off between a more equal distribution of income and overall economic growth. Furthermore, according to Barro, redistributive fiscal policies aiming at reducing disparities might have a negative impact on labour mobility and thus hinder important adjustment processes. Similar conclusions are drawn by Obstfeld and Peri (1999) who analyse the role of fiscal policy in economic adjustment processes within a single currency area. By comparing the US to some European countries and Canada, they find that adjustment happens in the US mainly through labour mobility while outside the US, adjustments are postponed because there is a higher reliance on interregional transfer payments.

Gemmell & Kneller (2002) estimate the impact of different fiscal variables on economic growth and convergence during the 1980s and 1990s. They find a negative impact of distortionary taxes on the average growth rate in a sample of 16 OECD countries as well as in a sample of 10 EU countries. A more recent study by Poulson & Kaplan (2008) on the impact of income taxation on economic growth in the US aims at isolating the effects of taxes on economic growth by controlling for progressivity in taxation, β -convergence and regional characteristics. Rather than studying the effect of the average tax rate, they use a measure for the marginal tax rate and find a negative impact of the marginal tax rate on the growth rate among those states that apply income taxes. They estimate the same equation for all US states and include a dummy for states that apply income taxes, which turns out to have a negative impact as well.

Some recent studies estimate the impact of redistribution on regional convergence in Europe. Meunier et al. (2007) investigate if national interpersonal transfer policies affect regional economic growth rates.

Using a sample of 230 NUTS2 regions from 1995 to 2002, they proxy the level of redistribution with an index of relative disposable to relative primary income of a region. Their transfer index allows for an analysis of net contributing regions and net benefiting regions separately. Taking into account the spatial dependence among regions, they find that transfers received have a positive impact on a poor region's growth rate while they acknowledge the presence of a simultaneity bias in the case of net contributing regions that does not allow for any evidence.

Algoed and Persyn (2009) who analyse β -convergence across 140 NUTS2 regions find different results. They first estimate the rate of interregional redistribution for each country in the sample, expressing how much, on average, of the relative difference in primary income is eliminated through redistribution. When accounting for the rate of redistribution in a cross-section setting with average growth rates over the period 1995-2007 and independent variables evaluated at their levels in 1995, they find β -convergence and a positive impact of the level of redistribution on growth. Including country fixed-effects, they find a typically lower rate of within-country β -convergence and a negative impact of redistribution on growth. Furthermore, by interacting the level of redistribution with the initial level of income, they find that redistribution slows convergence because the negative effect on growth is larger for initially poorer regions.

Another approach was adopted by Checherita et al. (2009). They analyse the role of net fiscal transfers for income and output convergence across 230 European regions between 1995 and 2005. They use a simultaneous equation system that allows for net transfers to be endogenously determined and also accounts for effects on labour motility. They proxy net fiscal transfers with the ratio of disposable to primary income and estimate the effect of net fiscal transfers in a split sample of what they call "heavily taxed regions" and "receiving regions and marginal payers". The findings suggest that higher taxes have a negative impact on growth in the sub-sample of heavily taxed regions and also a negative impact of fiscal transfers on growth in the sub-sample of receiving regions and marginal payers. Furthermore, they find that fiscal transfers have a stronger growth-reducing impact on richer regions than on poorer regions, which might lead to what they call "immiserising convergence", meaning that disparities decline due to slower growth of relatively richer regions. Moreover, they estimate a negative impact of net fiscal transfers on labour mobility and a negative impact of labour mobility on growth of the poor regions. As lower labour mobility has a positive impact on output growth, transfers have indirectly a positive impact on the growth of poor regions.

5. Empirical investigation

The empirical investigation includes two parts. First, absolute beta-convergence across European regions will be verified and second, the impact of interpersonal transfer payments on the growth rate of regions will be estimated.

5.1. Data description

We will focus on the growth of primary household income instead of GDP, due to the importance of interregional commuting workers which impact the regional income. If interpersonal transfers discourage working and outward commuting, they should have a negative impact on the growth of primary income. But as mentioned by Checherita et al. (2009), lower outward labour mobility has a positive impact on regional GDP growth which, on the contrary, might enhance income growth.

The dataset used for this part is entirely taken from Eurostat's regional household accounts with primary and disposable income measured in Purchase Power Standards per capita. Eurostat's measures primary and disposable income of households which reside in a particular region. Primary income includes several components, the most important of which are compensation of employees and property income. Disposable income is based on primary income which is reduced by current taxes on income or wealth, social contributions and other transfers paid by households and increased by social benefits and other transfers received by households.

The geographical unit of analysis is the NUTS⁵ 2 level.⁶

The dataset includes the following 16 countries:⁷ Austria, Belgium, Czech Republic, Finland, France, Germany, Greece, Ireland, Italy, The Netherlands, Poland, Portugal, Slovakia, Spain, Sweden and UK. This amounts to a total of 229 regions. The dataset includes the years 1995 throughout 2008. The remaining EU-countries are excluded from the analysis due to a lack of data available for the entire period or due to the fact that they comprise only one region at NUTS2 level, which does not allow for interregional transfers analysis.

5.1. Beta-convergence estimation - a cross section approach

Beta convergence implies that regions with lower initial income should have a higher growth rate, in other words, they are supposed to catch up.

In order to verify beta-convergence empirically, a standard beta-convergence model is estimated. For each region, the average growth rates of per capita primary income (*PINC*) between 1995 and 2008 are calculated and are then regressed on the respective levels in 1995. The average growth rate g of the primary income of a region i over the entire period under observation is calculated as follows:

$$g_i = \frac{1}{13} * \ln \left[\frac{PINC_{i, 2008}}{PINC_{i, 1995}} \right]$$

⁵ *Nomenclature of Territorial Units for Statistics*

⁶ http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:NUTS.

⁷ The extensive list of all regions can be found in Annex I.

Then, the following regression is estimated:

$$g_{PINC,i} = \alpha + \beta \ln(PINC_{i,1995}) + \varepsilon$$

A significant negative coefficient for β is a sign of absolute beta convergence. The results are reported in table 1.

Table 1: β -convergence between regions in PINC (Cross section data)

Dependent variable: average annual growth rate 1995-2008		
Variable	β	t-value
$\ln(PINC1995)$	-0.0298***	-31.66

Nobs: 229, asterisks indicate the statistical significance level: * = 10%, ** = 5%, *** = 1%; this notation will be kept throughout the remainder of the analysis.

The coefficient is negative and significant at a 1% level, suggesting absolute beta convergence among European regions. Regions with initially lower income – as measures by the relative levels in 1995 – have been growing faster. The main assumption made here is that all regions are structurally similar and they only differ in the initial level of income, since no other regional characteristics are controlled for.

In a second step, the standard beta-convergence model for primary income is estimated again across all European regions, but considering that the national “steady state” can vary from country to country. This hypothesis is accounted for by including country dummies in the regression. By doing so, we isolate the within country convergence from the inter-countries convergence.

Country dummies are jointly significant at less than 1%. This confirms the existence of different national steady states. As shown in table 2, within country convergence in income - even though significant at a 5% level - is much lower than the ones estimated previously across all European regions.

Table 2: β -convergence within countries (cross section data, country dummies)

Dependent variable: average annual growth rate of Primary income 1995-2008		
Variable	β	t-value
$\ln(PINC1995)$	-0.0048**	-2.47

Nobs: 229

Does this mean that, once considering national fixed specifications, poorer European regions are not converging to richer ones?

To answer this question we estimate the following ad-hoc model:

$$g_{pinc,i} = \alpha + \beta \ln(PINC_{i,1995}) + \gamma \text{REL}PINC95_i + \varepsilon$$

where $REL\text{PINC}95_i$ indicates the regional initial primary income relative to the national average.

Results are reported in tables 3 and 4. Estimations are done with, as well as without country dummies.

Table3: convergence between regions (cross section data)

Dependent variable: PINC average annual growth rate 1995-2008		
Variable	coefficient	t-value
ln(PINC1995)	-0.0315***	-38.10
RELPINC95	0.0299***	9.16

Nobs: 229

Table4: convergence within countries (cross section data with country dummies)

Dependent variable: PINC average annual growth rate 1995-2008		
Variable	coefficient	t-value
ln(PINC1995)	-0.0599***	-3.77
RELPINC95	0.0567***	3.49

Nobs: 229

It clearly seems that the growth rate is higher for initially poorer regions but that it is lower if the region is poor with respect to the country it belongs to. This result is only a statistical observation but could be attributed to the fact that the growth of relatively poor regions suffers from the persistence of structural elements that lowers their potential for economic development. One of those elements could potentially be the existence of transfers, which will be tested in the next section.

5.2. Do transfers matter? A panel approach

To estimate the impact of transfers on growth, our ad-hoc model is augmented with an index of transfers' intensity. Transfers are considered separately for receiving regions and contributing regions as their impact on regional growth follows different channels. For receiving regions the transfer intensity will be noted *TRSFR*, for contributing regions *TRSFC*.

The transfer index *TRSFR* for a receiving region *i* is computed as the following ratio:

$$TRSFR_i = \frac{DISP_i / DISP_n}{PINC_i / PINC_n}$$

where *PINC* and *DISP* are the primary and disposable income respectively, measured in region *i* and in country *n*. For receivers, this ratio is higher than one and a higher transfers' intensity corresponds to a higher index. For contributors, *TRSFR* is null. For simplicity, the transfers' index for contributors *TRSFC* is computed with the inverse of the receivers' formula such that, also in this case, a higher index corresponds to a higher transfers' intensity. For receivers, *TRSFC* is zero.

Estimations are done in a panel setting which allows controlling for regional fixed heterogeneity.

Growth rates are computed for 4 ten-year periods (1995-2005, 1996-2006, 1997-2007, 1998-2008). Independent variables are considered at their initial level for each period.

Estimations in table 5 do not take into account time dummies, while estimations in table 6 do. In each table we consider successively no territorial dummies, either only country dummies or only region dummies.

Table 5: Transfers impact on PINC growth (panel data, without time dummies)

Dependent variable: 10 years PINC average annual growth rate			
Variable	Panel Estimation 1 Coefficient (t-value)	Panel Estimation 2 Coefficient (t-value)	Panel Estimation 3 Coefficient (t-value)
ln(PINC0)	-0.0277*** (-41.36)	-0.0579*** (-18.03)	-0.0589*** (-21.09)
RELINCO	0.0294*** (8.64)	0.0555*** (13.91)	0.0033 (0.854)
TRSFRO	0.0132 (1.35)	0.0005 (0.08)	0.0351 (1.06)
TRSFRO	0.1175 (1.19)	0.0001 (0.01)	0.0331 (1.00)
Country dummies	No	Yes	No
Region dummies	No	No	Yes
Time dummies	No	No	No

Nobs: 916

Table 6: Transfers impact on PINC growth (panel data, with time dummies)

Dependent variable: 10 years PINC average annual growth rate			
Variable	Panel Estimation 4 Coefficient (t-value)	Panel Estimation 5 Coefficient (t-value)	Panel Estimation 6 Coefficient (t-value)
PINC0	-0.0278*** (-41.31)	-0.0968*** (-23.64)	-0.1015*** (-31.25)
RELINCO	0.0294*** (8.64)	0.0937*** (20.39)	0.0327** (2.20)
TRSFRO	0.0133 (1.36)	-0.0147** (-2.30)	-0.0262 (-0.96)
TRSFRO	0.01194 (1.21)	-0.0151** (-2.35)	-0.0267 (-0.99)
Country dummies	No	Yes	No
Region dummies	No	No	Yes
Time dummies	Yes	Yes	Yes

Nobs: 916

Panel estimation 1, 2 and 4 confirm the cross section results in tables 3 and 4 regarding the impact of the initial absolute and relative income on subsequent growth.

In all of the estimations but one, the transfers' intensity has no significant impact on the regions' growth.

Only panel estimation 5 with country and time dummies shows a significant negative impact of transfers' intensity both for receiving and contributing regions. This result is similar to Algoed and Persyn's one. However, this conclusion is not maintained when taking into account regional fixed effects as in panel estimation 6. Once controlling for regional fixed heterogeneity, transfers show no significant impact on regional growth and hence on regional convergence.

6. Conclusion

The neoclassical growth theory predicts convergence among economies if they have the same characteristics and only differ in terms of their initial level of GDP or income. The neoclassical growth theory provides positive predictions for convergence, at least as long as economies are similar. Endogenous growth theory on the contrary, does not predict convergence, there is no "catching up" of poor economies to richer ones. It predicts constant growth rates, independent of the initial conditions of an economy.

The most pessimistic model for regional inequalities is the model of economic geography. Along with economic integration in Europe and the falling trade costs induced by this process, production activities are predicted to agglomerate in some regions – the core regions, while other regions will remain peripheral, if production activities experience increasing returns to scale. Regional inequalities might consequently increase rather than decrease. Only if trade costs are tending towards zero, a re-dispersion of economic activities might happen, but even if integration in Europe is proceeding further, zero trade costs are not a realistic assumption.

Summing up the empirical evidence on convergence, some consensus exists on several facts:

- Absolute β -convergence can be observed in homogenous datasets over the last decades, including data on European regions.
- The overall decline in disparities in Europe is largely due to a convergence across countries rather than within countries.

It is clear that regions that are relatively poor with respect to their country have a lower growth rate as they suffer from permanent structural difficulties that slow down their economic development. Some empirical studies showed that transfers could be one of the elements that hinder growth, others conclude that the opposite is true.

We tried to estimate the impact of transfers' intensity on growth in a panel setting based on 229 European regions and 4 periods of 10 years while distinguishing transfers of receiving regions and contributing regions. When taking into account the regional heterogeneity and time dummies, the impact of transfers seems to be not significant.

However, a more sophisticated model of growth causality should be developed before concluding on the impact of transfers on receiving and contributing regions and convergence.

Literature

- Acemoglu, D. (2009). *Introduction to modern economic growth*. Princeton: Princeton University Press.
- Algoed, K., & Persyn, D. (2009). Interregional Redistribuition, Growth and Convergence. *Vives Discussion Paper*(4).
- Arbia, G., & Piras, G. (2005). Convergence in per-capita GDP across European regions using panel data models extended to spatial autocorrelation effects. *ISAE Working papers*(n.51).
- Barro, R. E. (October 1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*(vol. 98(5)), p. 103-126.
- Barro, R. E., & Sala-i-Martin, X. (1992). Public Finance in Models of Economic Growth. *Review of Economic Studies*(vol. 59(4)), p. 645-61.
- Barro, R. J. (1999). Inequality, Growth and Investment. *NBER Working Papers*(7038).
- Barro, R. J., & Sala-i-Martin, X. (1991). Convergence across States and Regions. (The Brooking Institution, Ed.) *Brooking Papers on Economic Activity*(vol.22(1992-1)), p. 107-182.
- Barro, R. J., & Sala-i-Martin, X. (1992a). Convergence. *The Journal of Political Economy*(100(2)), p. 223-251.
- Barro, R. J., & Sala-i-Martin, X. (2004). *Economic Growth* (2 Edition.). Massachusetts: MIT.
- Bernard, A. B., & Durlauf, S. N. (Apr-June 1995). Convergence in International Output. *Journal of Applied Econometrics, Volume 10*(2), p. 97-108.
- Boldrin, M., & Canova, F. (2001). Europe's Regions: Income Disparities and Regional Policies. *Economic Policy*(16(32)), p. 207-253.
- Bouvet, F. (8 2010). EMU and the dynamics of regional per capita income inequality in Europe. *The Journal of Economic Inequality*(3 (September)), p. 323-344.
- Cappelen, A., Castellacci, F., Fagerberg, J., & Verspagen, B. (2002). The impact of regional support on growth and convergence in the European Union. (Centre for Technology, Innovation and Culture, Ed.) *Working Papers*(12).
- Checherita, C., Nickel, C., & Philipp, R. (March 2009). The role of fiscal transfers for regional economic convergence in Europe. (ECB, Ed.) *ECB Working Paper Series*(No 1029).
- Coulombe, S., & Lee, F. C. (1998). Évolution à long terme de la convergence régionale au Canada. *L'Actualité économique*(vol.74, no.1), p. 5-27.

- Fagerberg, J., & Verspagen, B. (September 1996). Heading for Divergence? Regional growth in Europe reconsidered. *Journal of Common Market Studies*(Vol.34 No 3).
- Fujita, M., Krugman, P., & Venables, A. (1999). *The spatial economy: cities, regions and international trade*. MIT Press.
- Gaulier, G., Hurlin, C., & Jean-Pierre, P. (1999). Testing Convergence: A Panel Data Approach. *Annales d'économie et de statistique*(No 55-56 - 1999).
- Gemmell, N., & Kneller, R. (2002). Fiscal policy, Growth and Convergence in Europe. (European Economy Group, Ed.) *Working paper series*(No. 14/2002).
- Gérard-Varet, L.-A., & Mougeot, M. (2001). L'État et l'aménagement du territoire. *Les Rapports du Conseil d'analyse économique* (no. 31), p. 45-110.
- Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy*(99(3)), p. 484-499.
- Krugman, P., & Venables, A. J. (1995). Globalization and the inequality of nations. *Quarterly Journal of Economics*(110(4)), p. 857-880.
- Lambert, P. J. (2001). *The distribution and redistribution of income*. Manchester: Manchester University Press.
- Lucas, R. E. (July 1988). On the mechanics of economic development. *Journal of Monetary Economics, Elsevier*(vol.22(1)), p. 3-24.
- Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*(Vol. 107, No.2 (May, 1992)), p. 407-437.
- Meunier, O., Mignolet, M., & Mulquin, M. E. (2007). Interpersonal transfers: Do they impact the growth of poor and rich European regions? (Asociación Espanola de Ciencia Regional, Ed.) *Investigaciones Regionales*(primavera, no.010), p. 155-170.
- Obstfeld, M., & Peri, G. (June 1999). Regional Nonadjustment and fiscal policyf: Lessons from EMU. (N.B.E.R., Ed.) *NBER Working paper series*(No. 6431).
- Poulson, B. W., & Kaplan, J. G. (2008). State income taxes and economic growth. (Cato Institute, Ed.) *Cato Journal*(Vol.28, No.1 (Winter)).
- Puga, D. (1999). The rise and fall of regional inequalities. *European Economic review*(43(2)), p. 303-334.
- Puga, D. (2002). European regional policies in light of recent location theories. *Journal of Economic Geography*(vol.2(4) October), p. 373-406.
- Quah, D. (1995). Empirics for Economic Growth and Convergence. *Center for Economic Performance (C.E.P.R.) Discussion Papers*(No. 253).

- Rebelo, S. T. (1991). Long-run policy analysis and long-run growth. *Journal of Political Economy*(99 (1991)), p. 500-521.
- Romer, P. M. (October 1986). Increasing returns and long-run growth. (University of Chicago Press, Ed.) *Journal of Political Economy*(vol.94(5)), p. 1002-1037.
- Sala-i-Martin, X. (1990). On Growth and States. *Ph.D Dissertation, Harvard University*.
- Sala-i-Martin, X. (1996). Regional cohesion: Evidence and theories of regional growth and convergence. *European Economic Review*(40 (1996)), p. 1325-1352.
- Senger, K. (2011). Interregional transfers and economic convergence of regions. *Master Thesis, FUNDP*.
- Tesch, W. R. (2008). *Public sector economics*. Houndsmills, Basingstoke, Hampshire: PALGRAVE MACMILLAN.

Annex

List of regions included in the analysis

Belgium (11)

Région de Bruxelles; Prov. Antwerpen; Prov. Limburg; Prov. Oost-Vlaanderen; Prov. Vlaams-Brabant; Prov. West-Vlaanderen; Prov. Brabant Wallon; Prov. Hainaut; Prov. Liège; Prov. Luxembourg (BE); Prov. Namur

Czech Republic (8)

Praha, Střední Čechy, Jihozápad, Severozápad, Severovýchod, Jihovýchod, Střední Morava, Moravskoslezsko

Germany (39)

Stuttgart, Karlsruhe, Freiburg, Tübingen, Oberbayern, Niederbayern, Oberpfalz, Oberfranken, Mittelfranken, Unterfranken, Schwaben, Berlin, Brandenburg – Nordost, Brandenburg – Südwest, Bremen, Hamburg, Darmstadt, Gießen, Kassel, Mecklenburg-Vorpommern, Braunschweig, Hannover, Lüneburg, Weser-Ems, Düsseldorf, Köln, Münster, Detmold, Arnsberg, Koblenz, Trier, Rheinhessen-Pfalz, Saarland, Chemnitz, Dresden, Leipzig, Sachsen-Anhalt, Schleswig-Holstein, Thüringen

Ireland (2)

Border, Midland and Western, Southern and Eastern

Greece (13)

Anatoliki Makedonia Thraki, Kentriki Makedonia, Dytiki Makedonia, Thessalia, Ipeiros, Oinía Nisia, Dytiki Ellada, Sterea Ellada, Peloponnisos, Attiki, Voreio Aigaio, Notio Aigaio, Kriti

Spain (17)

Galicia, Principado de Asturias, Cantabria, País Vasco, Comunidad Foral de Navarra, La Rioja, Aragón, Comunidad de Madrid, Castilla y León, Castilla-La Mancha, Extremadura, Cataluña, Comunidad Valenciana, Illes Balears, Andalucía, Región de Murcia, Canarias

France (22)

Île de France, Champagne-Ardenne, Picardie, Haute-Normandie, Centre, Basse-Normandie, Bourgogne, Nord – Pas-de-Calais, Lorraine, Alsace, Franche-Comté, Pays de la Loire, Bretagne, Poitou-Charentes, Aquitaine, Midi-Pyrénées, Limousin, Rhône-Alpes, Auvergne, Languedoc-Roussillon, Provence-Alpes-Côte d'Azur, Corse

Italy (21)

Piemonte, Valle d'Aosta, Liguria, Lombardia, Provincia Autonoma Bolzano, Provincia Autonoma Trento, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Toscana, Umbria, Marche, Lazio, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia, Sardegna

The Netherlands (12)

Groningen, Friesland, Drenthe, Overijssel, Gelderland, Flevoland, Utrecht, Noord-Holland, Zuid-Holland, Zeeland, Noord-Brabant, Limburg (NL)

Austria (9)

Burgenland, Niederösterreich, Wien, Kärnten, Steiermark, Oberösterreich, Salzburg, Tirol, Vorarlberg

Poland (16)

Łódzkie, Mazowieckie, Małopolskie, Śląskie, Lubelskie, Podkarpackie, Świętokrzyskie, Podlaskie, Wielkopolskie, Zachodniopomorskie, Lubuskie, Dolnośląskie, Opolskie, Kujawsko-Pomorskie, Warmińsko-Mazurskie, Pomorskie

Portugal (7)

Norte, Algarve, Centro, Lisboa, Alentejo, Região Autónoma dos Açores, Região Autónoma da Madeira

Slovakia (4)

Bratislavský kraj, Západné Slovensko, Stredné Slovensko, Východné Slovensko

Finland (5)

Itä-Suomi, Etelä-Suomi, Länsi-Suomi, Pohjois-Suomi, Åland

Sweden (8)

Stockholm, Östra Mellansverige, Småland med öarna, Sydsverige, Västsverige, Norra Mellansverige, Mellersta Norrland, Övre Norrland

United Kingdom (35)

Tees Valley and Durham; Northumberland and Tyne and Wear; Cumbria; Cheshire; Greater Manchester; Lancashire; Merseyside; East Yorkshire and Northern Lincolnshire; North Yorkshire; South Yorkshire; West Yorkshire; Derbyshire and Nottinghamshire; Lincolnshire; Herefordshire; Worcestershire and Warwickshire; Shropshire and Staffordshire; West Midlands; East Anglia; Bedfordshire and Hertfordshire; Essex; Inner London; Outer London; Berkshire, Buckinghamshire and Oxfordshire; Surrey, East and West Sussex; Hampshire and Isle Of Wight; Kent; Gloucestershire, Wiltshire and Bristol/Bath area; Dorset and Somerset; Cornwall and Isles of Scilly; Devon; West Wales and The Valleys; East Wales; Eastern Scotland; South Western Scotland; Northern Ireland